

Development of the Head and Neck: An Interactive Computer Program

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The major aim of this project is to provide interactive computer based courseware that can be used by the medical student and others to supplement his or her learning of this very important aspect of basic biomedical education. Embryology is a science that depends on the ability of the student to visualize dynamic changes in structure which occur in four dimensions - X, Y, Z, and time. Traditional didactic methods, including lectures employing photographic slides and laboratories employing histological sections, are limited to two dimensions - X and Y. The third spatial dimension and the dimension of time cannot be readily illustrated using these methods. Computer based learning can be used effectively to illustrate developmental processes in all four dimensions. This methodology can also be used to foster the critical skills of independent learning and problem solving.

This program is designed to allow the student to learn, independently and at an individual pace, the essential aspects of the development of the head and neck of the human embryo. The program is organized into seven lessons that follow the sequence of development of the various portions of the head and neck, but the student may work through these lessons in any sequence. Computer generated text and graphics are presented, and the student is able to interactively direct the subsequent development of the system using the touch screen. The program provides feedback to the student, and then displays graphically the next stage of development. Computer animation techniques are employed to illustrate these developmental processes.

Lesson I: Pharyngeal Arches

This segment describes the formation of the six pairs of pharyngeal arches. The student can follow the subsequent development of each of these arches and the structures that are derived from the cartilage, muscle mass, nerve, and artery within each arch..

Lesson II: Pharyngeal Pouches

In this segment, the establishment of the endodermal derivatives of the pharynx is examined. The student may follow the time course of development and the derivatives of each of the four pairs of pharyngeal pouches.

Lesson III: Tongue

The formation of the tongue from the primordia in the floor of the pharynx is examined in this lesson.

Lesson IV: The Thyroid Gland

The early development and migration of the thyroid gland from the foramen cecum in the floor of the pharynx is demonstrated in this lesson.

Lesson V: The Face

In this lesson, the development of the skeleton and surface features of the face is examined.

Lesson VI: The Palate

The normal formation of the hard and the soft palate from the maxillary process and the medial nasal process is illustrated using computer animation. The development of several types of cleft palate is demonstrated as well.

Lesson VII: The Eye

The formation of the eye, including the optic cup, the lens placode, and other surrounding structures, is illustrated in this lesson.

On-Line Atlas

Images of complete series of histological sections of pig embryos at various ages and orientations are available for view. At any stage in the program, the student can call up this atlas and examine the actual specimens which correspond to the computer animations. Thus, a laboratory-like experience is built into the program.